

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

ORDER NO. 87-108

SITE CLEANUP ORDER FOR:

LAWRENCE LIVERMORE NATIONAL LABORATORY
AND U.S. DEPARTMENT OF ENERGY
LIVERMORE
ALAMEDA COUNTY

The California Regional Water Quality Control Board, San Francisco Bay Region (hereinafter called the Board), finds that:

1. Lawrence Livermore National Laboratory (LLNL) operates a research facility under contractual agreements with the U.S. Department of Energy (DOE) on 811 acres of land owned by DOE in the Livermore Valley, Alameda County. Lawrence Livermore National Laboratory and the U.S. Department of Energy are hereinafter both dischargers. For the purposes of this Order, DOE will be responsible for compliance in the event that LLNL fails to comply with the requirements of this Order.
2. The site is located in the eastern region of the Valley known as the Mocho I subbasin (Attachment 1). This facility was first used in the 1940's by the U.S. Navy as a Naval Air Station and, subsequently, it has served as a federal research facility by the U.S. Department of Energy and its predecessor, the U.S. Atomic Energy Commission. From the beginning of its use by the federal government, hazardous materials have been used, stored, and disposed of on the property. Solvents and chemicals used on site, either currently or historically, which have been found in the ground water on-site and/or off-site, include trichloroethylene (TCE), 1,1,1-trichloroethane (TCA), tetrachloroethylene (PCE), 1,1-dichloroethylene (1,1-DCE), 1,1-dichloroethane (1,1-DCA), carbon tetrachloride, and other halogenated organic and petroleum hydrocarbons.
3. A common means of disposing of hazardous waste primarily during Navy occupation of the site was by burying it in on-site landfills. There are at least two known landfills on the facility where solvents and other chemicals are known to have been disposed (Attachment 3).
4. Other suspected sources of releases of chemicals include spillage from outdoor storage facilities that existed throughout the site, from underground storage tanks and pipelines, and from past discharges to the site storm drain system. Chemical handling and storage facilities are being upgraded in conformance with existing Resource, Conservation and Recovery Act requirements administered by state and federal agencies.
5. In April 1983, the dischargers drilled several monitoring wells on its property. Some monitoring wells showed contaminants (e.g., TCE and PCE) to be present in the ground water. In December 1983, private

wells immediately downgradient of the discharger were sampled and found to be polluted with the same chemicals. The California Department of Health Services (DOHS) issued an Order of Compliance on September 11, 1984 requiring the dischargers to notify owners of contaminated drinking water wells and to supply the affected residences and businesses with a clean water supply.

6. Subsequent work was performed by LLNL involving drilling of soil borings on the site to better define the sources of the contamination. Various locations showed soil contamination.
7. A second phase of work was begun in January 1985 with the primary purpose of defining the vertical and lateral off-site extent of the ground water pollution in the southwest corner of the site as well as providing full definition of the local hydrogeology.
8. The Regional Board adopted Order No. 85-134 on November 20, 1985 prescribing waste discharge requirements for LLNL to complete full investigation of the vertical and lateral extent of soil and ground water pollution at the site and to develop and implement cleanup measures at all on-site and off-site polluted areas.
9. On December 17, 1986, the Regional Board adopted Order No. 86-95 issuing waste discharge requirements for LLNL for the treatment and disposal on land of short-term hydraulic pump test waters, routine sampling and well development waters from LLNL's monitoring wells. Contaminated monitoring well water is treated in a portable air stripping unit to remove volatile organic contaminants before discharge onto land. Effluent monitoring data for the air stripping unit shows that typically better than 98% of volatile organic contaminants are removed. Additional work is needed to develop the fuel hydrocarbon treatment process if contaminated monitoring well water will be treated in the portable air stripping unit. Direct discharge or surface runoff to surface waters is prohibited.
10. More than 160 monitoring wells have been drilled to date. The ground water pollution has not been fully delineated and no cleanup nor containment has begun.
11. Work completed so far has shown that there is more than one point of discharge of hazardous material into the underlying ground water at the site. These include a gasoline spill from a group of underground tanks where total fuel hydrocarbons in ground water range in concentration from < 0.5 to 240,000 ppb (parts per billion), pollution in the area of the old landfills with the main contaminant being TCE ranging from < 0.5 to 5,800 ppb, contamination in the southeast corner with TCE and carbon tetrachloride ranging from < 0.5 to 5,300 ppb and from < 0.5 to 83 ppb, respectively, and pollution in the southwest corner primarily with PCE ranging from < 0.5 to 1,100 ppb.
12. The hydrogeology of the area has proven to be very heterogeneous. Special sampling techniques have been used in the drilling of boreholes to determine which water-bearing zones warrant monitoring wells. Ground water flows generally to the west in the northeast

quarter and western half of the LLNL site, and in the area adjacent to LLNL to the west. In the southeast quarter of the site, ground water flows generally to the south.

13. In a letter dated March 17, 1987, LLNL requested revision of its waste discharge requirements in order to amend the time schedule for work and to perform a detailed hydrogeologic assessment earlier than required in the current requirements. The revisions of this Order accommodate additional and more complete subsurface investigations that are needed based on LLNL's previous work. This Order also conforms with the enforcement guidelines of the State Water Resources Control Board and Regional Board for ground water investigation and cleanup.
14. Existing private wells in the Mocho I province are used for irrigation and domestic supply. In the Mocho II province which begins approximately one and one-half miles west of the site, the California Water Service operates several municipal wells.
15. The Environmental Protection Agency commenced negotiations in April 1987 with DOE, LLNL, and interested state and local agencies to enter into an interagency agreement for site investigation and remediation in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act as amended by the Superfund Amendments Reauthorization Act of 1986. The interagency agreement may necessitate Board consideration of changes in the time schedules required by this Order.
16. The Regional Board adopted a revised Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan) on December 17, 1986. The Basin Plan contains water quality objectives for non-tidal waters including Arroyo Mocho, Arroyo Seco, Arroyo Las Positas, Arroyo de la Laguna, and their tributaries and for the Livermore-Amador Valley ground waters.
17. The existing and potential beneficial uses of the ground waters underlying the Livermore-Amador Valley ground water basin and its subbasins include:
 - a. Municipal supply
 - b. Industrial supply
 - c. Industrial service supply
 - d. Agricultural supply
18. The existing and potential beneficial uses of the surface waters in the Livermore-Amador Valley ground water basin including Arroyo Mocho, Arroyo Seco, Arroyo Las Positas, Arroyo de la Laguna and their tributaries include:
 - a. Contact and non-contact water recreation
 - b. Wildlife habitat
 - c. Ground water recharge
 - d. Fish migration and spawning
19. The dischargers have caused or permitted and threaten to cause or

permit, waste to be discharged or deposited where it is or probably will be discharged to waters of the State and creates or threatens to create a condition of pollution or nuisance.

20. This action is an order to enforce the laws and regulations administered by the Board. This action is categorically exempt from the provisions of the California Environmental Quality Act (CEQA) pursuant to Section 15321 of the Resources Agency Guidelines.
21. The Board has notified all interested agencies and persons of its intent under Section 13304 of the California Water Code to prescribe Site Cleanup Requirements for the discharge and has provided them with the opportunity for a public hearing and an opportunity to submit their written views and recommendations.
22. The Board, at a public meeting, heard and considered all comments pertaining to this discharge.

IT IS HEREBY ORDERED, pursuant to Section 13304 of the California Water Code, that Lawrence Livermore National Laboratory and the U.S. Department of Energy shall cleanup and abate the effects described in the above findings as follows:

A. PROHIBITIONS

1. The discharge or disposal of wastes or hazardous materials in a manner which will degrade the water quality or adversely affect the beneficial uses of the ground waters of the State is prohibited.
2. The discharge of wastes or hazardous materials through direct surface discharge or runoff or through subsurface transport which will degrade the water quality and adversely affect the beneficial uses of the surface waters of the State is prohibited.
3. Activities associated with the subsurface investigation and cleanup which will cause significant adverse migration of the pollution is prohibited.
4. The cleanup and containment of polluted ground water by the dischargers shall not adversely spread any pollution originating from other sites.

B. SPECIFICATIONS

1. The location of all potential sources of hazardous material discharges on the site shall be identified and their contribution to the on-site soil and ground water pollution shall be assessed and defined.
2. The horizontal and vertical extent of the off-site and on-site ground water pollution shall be assessed and defined.
3. The local and regional hydrogeologic conditions shall be defined in the areas of and contiguous to identified pollution.

4. Cleanup alternatives will be developed, evaluated, and implemented.
5. The potential for private wells in the area of the pollution to act as conduits for the spread of the pollution shall be identified. Wells identified as actual or potential conduits shall be properly sealed or abandoned, to the extent legally possible.
6. The storage, handling, treatment or disposal of polluted soil or ground water shall not create a nuisance as defined in Section 13050 (m) of the California Water Code.
7. Monitoring well waters which may contain volatile organic pollutants, petroleum hydrocarbons, or other contaminants that are generated from well development, routine sampling, and hydraulic testing activities shall be treated before discharge onto land in order to meet concentrations of less than two times the action level for each compound specified by the California Department of Health Services for drinking water.

C. PROVISIONS

1. The Lawrence Livermore National Laboratory shall perform all investigation and remedial work in accordance with the requirements of this Order. For the purposes of enforcing this Order, the U.S. Department of Energy shall be responsible for achieving full compliance with this Order in the event that the Lawrence Livermore National Laboratory fails to comply with the requirements of this Order.
2. LLNL shall submit to the Board technical reports on self-monitoring work performed according to a program approved by the Board's Executive Officer.
3. In order to comply with Specification B.1, the LLNL shall meet the following compliance time schedule:

<u>TASK</u>	<u>COMPLIANCE DATE</u>
a. Submit a workplan and time schedule to implement corrective measures for all leaking underground tanks containing hazardous materials, including gasoline, diesel fuel and rinse tanks, identified in the discharger's July 1986 report entitled "Testing Underground Tanks for Leak Tightness at LLNL". The workplan also include a leak testing program to be performed on an annual basis.	November 1, 1987
b. Submit a technical report transmitting the results of the corrective measures described above.	October 1, 1988

PROVISION 3 SCHEDULE OF TASKS AND COMPLIANCE DATES
TABLE 1

REPORTS DOCUMENTING COMPLIANCE WITH TASKS WILL BE SUBMITTED BY DATES SHOWN BELOW

STUDY AREAS	TASKS			
	a. RELEASE REPORT	b. EXTENT REPORT	c. REMEDIAL ALTERNATIVES REPORT	d. IMPLEMENTATION REPORT
1. SW CORNER	October 15, 1987	December 15, 1988	October 15, 1989	April 15, 1991
2. BLDG. 403 (gasoline leak)	Not applicable	(July 1, 1986) ^a	January 15, 1988	June 15, 1989
3. SE CORNER	(July 1, 1986) ^a	(December 1, 1986) ^a	April 1, 1988	November 1, 1989
4. SOUTH CENTRAL (Taxi Strip/Old Salvage Yard/ E. Traffic Circle)	(September 15, 1987) ^a	August 1, 1988	April 1, 1989	November 1, 1990
5. REMAINDER OF SITE (includes pollution associated with Well 11A1)	December 15, 1987	July 1, 1989	April 1, 1990	November 1, 1991
<u>OFFSITE AREAS</u>				
WITHIN AREA 1 [*] (includes pollution associated with SW Corner)	Not applicable	(July 1, 1986) ^a	September 1, 1987 (Draft) November 15, 1987 (Final)	March 1, 1989

^{*} Area 1 is defined as the region south of Interstate 580, north of East Avenue, west of the western border of the developed area of the laboratory, and east of the boundary between the Mocho I and Mocho II ground water provinces.

^a Report has been submitted.

4. In order to comply with Specifications B.1, B.2, B.3 and B.4, LLNL shall complete the tasks listed in Table 1 and described below:
 - a. The Release Report shall be a technical report satisfactory to the Executive Officer determining whether a release has occurred within the On-Site or Off-Site Area and identifying the suspected source(s) and pollutants. This report shall provide all available information to support its findings including soil and water quality data, previous technical reports, and facility records. The Release Report for the Remainder of the Site shall include a detailed workplan describing the investigations to be performed to determine the vertical and lateral extent of pollution and the hydrogeology of the site.
 - b. The Extent Report shall be a technical report satisfactory to the Executive Officer determining the full lateral and vertical extent of pollution in soil and ground water from all confirmed sources. This report shall include a detailed hydrogeologic assessment for each Area, to the extent possible, which shall:
 - i. Determine the hydraulic characteristics of all water-bearing zones found to have pollution by using appropriate test methods.
 - ii. Determine the existing and potential migration of polluted ground water from one water-bearing zone to another.
 - iii. Determine the recharge and discharge areas of the polluted area and how these factors affect pollutant migration on a long-term and short-term basis.
 - iv. Determine the directions and velocities of ground water flow in each of the water-bearing zones where pollutants are found.
 - v. Assess the influence, if any, that pumping from private and public wells may have on the ground water flow and pollutant migration.
 - vi. Assess the hydrogeology and overall pollutant migration of the entire site and affected off-site vicinity as part of investigations for Area 5 (Remainder of the Site) in Table 1.
 - c. The Remedial Alternatives Report shall be a technical report satisfactory to the Executive Officer evaluating alternative interim and final remedial measures. This report should evaluate detailed information for each alternative, including:
 - 1) sufficient geotechnical and hydraulic information to establish the effectiveness of the interim and/or final remedial measure(s),
 - 2) details of the hydraulic containment

and cleanup system, if proposed, which includes the estimated flow capture zone for extraction wells, the estimated cones of depression, presentation of chemical monitoring data, and other pertinent information, 3) location of discharge of extraction well water, if discharge is an element of the remedial alternative, 4) details of removal and/or cleanup of polluted soils and the disposal site, if soil removal or cleanup is an element of the remedial alternative, 5) a projection of cost, 6) benefits, and 7) impacts on public health, welfare, and environment. The report shall also consider the guidance provided by Subpart F of the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR Part 300), Section 25356.1(c) of the California Health and Safety Code, and CERCLA guidance documents. An alternative may consist of both interim and final remedial measures implemented over a specified period of time.

The Executive Officer will present the recommended interim and final remedial alternative(s) to the Regional Board for consideration and approval. If necessary, the dischargers may be required to submit additional detailed information satisfactory to the Executive Officer prior to Board consideration. Within ninety (90) days following Board approval of remedial actions for a study area, LLNL shall submit a comprehensive time schedule satisfactory to the Executive Officer for implementation of all approved remedial measures.

- d. The Implementation Report shall be a technical report discussing in detail the final approved remedial alternative at the completion of construction and the start of full operation of all remedial measures.
 - e. The Release Report (Provision 3.a) may be submitted as part of the monthly progress reports. The Extent Report (Provision 3.b), the Remedial Alternatives Report (Provision 3.c), and the Implementation Report (Provision 3.c) shall be submitted as separate technical reports.
5. In order to comply with Specification B.5, LLNL shall meet the following compliance time schedule for all Areas outlined in Table 1 with the exception of Off-Site Area 1 (West of LLNL):

<u>TASK</u>	<u>COMPLIANCE DATE</u>
a. Identify private wells, to the extent feasible, in the vicinity of the site and contaminated areas with potential to act as conduits for inter-aquifer cross-contamination.	November 1, 1987
b. Locate and collect additional information on private wells identified in Provision 4.a to assess if the wells may be potential conduits for inter-aquifer cross-contamination.	November 1, 1987

c. Develop a program to respond to any potential conduits and submit a technical report with options for addressing closure.

November 1, 1987

6. Documentation of compliance with the Specifications and Provisions of this Order shall include ground water contour maps, pollutant concentration contour maps, geologic cross-sections, geophysical and lithologic logs, and laboratory analyses. The spacing of the monitoring wells and/or borings shall be sufficiently close to reduce errors in interpretation between data points. This documentation shall be updated and submitted with each technical report required under this Order, as appropriate.
7. Discharges onto land of well waters containing fuel hydrocarbons generated by hydraulic testing in the Building 403 Area may not begin until satisfactory treatment to meet Specification B.7 above has been demonstrated through the submittal of pertinent information and approved by the Executive Officer.
8. LINL shall submit a list of wells to be hydraulically tested no later than five working days prior to the start of the testing of each group of wells to be tested. This list shall be supplemented with pertinent technical information including the estimated flow rate and quantity to be pumped for each test well, duration of pumping for each test well, concentration of total volatile organic compounds in ground water for each test well, depth of the perforated interval, the test zone(s), the proposed observation wells, a location map of the test and observation wells, and the specific analytical test method for effluent testing.
9. A sample of treatment unit effluent shall be collected at the start of each test week and analyzed for total volatile organic compounds (EPA Test Method 601) and in the Building 403 Area for total fuel hydrocarbons by GC/FID analysis. All test results (including any additional sampling performed by the discharger), the final quantity pumped for each well, and the duration of the test shall be contained and briefly discussed in the monthly progress reports submitted to the Board.
10. Should effluent results show failure to meet Specification B.7 above, LINL shall cease testing, treatment, and discharge operations immediately until compliance with effluent levels can be achieved. Incidents of non-compliance, corrective actions, and the dates when compliance is again achieved shall be discussed in the monthly progress report.
11. The discharge of properly treated well development, routine sampling and test waters into the sanitary sewer is not regulated by this Order.
12. The dischargers must file an application for and obtain a National

Pollutant Discharge Elimination System (NPDES) permit from the Board prior to any direct discharge or surface runoff to surface waters of the State from the dischargers' pollution investigations and remedial activities.

13. If the dischargers are delayed, interrupted or prevented from meeting one or more of the compliance dates specified in this Order, LINL shall promptly notify the Executive Officer by telephone.
14. LINL shall submit monthly summaries of its progress towards compliance with the Specifications and Provisions contained in this Order, including: a) a summary of work completed since submittal of the previous report, and work projected to be completed by the time of the next report, b) identification of any obstacles which may threaten compliance with the schedule of this Order and what actions are being taken to overcome these obstacles, and c) in the event of non-compliance with Provisions C.2, C.3 or C.4 or any other Prohibition, Specification or Provision of this Order, written notification which clarifies the reasons for non-compliance and which proposes specific measures and a schedule to achieve compliance. This written notification shall identify work not completed that was projected for completion, and shall identify the impact of non-compliance on achieving compliance with the remaining requirements of this Order. The monthly progress report should be received by the Regional Board staff by the fifteenth (15th) day of the following month.
15. LINL shall report to the Board annually commencing January 15, 1989 for the 1988 calendar year, on the effectiveness of the ground water containment cleanup program. The report shall include updated water table and piezometric surface maps for all affected water-bearing zones and shall discuss the treatment and disposal of any extracted ground water, the status of the containment of the plume, the expected results of future extractions, and any plans for additional cleanup work needed to adequately implement remedial measures or to contain the plume. The annual report shall be submitted with the December monthly progress report due on January 15th of the following year.
16. LINL shall submit a complete quality assurance/quality control program for investigations and sampling of soil and water related to investigations by October 1, 1987. LINL shall update and revise the program as needed and shall identify and submit copies of revised sections to the Board with the monthly progress reports.
17. Results from the quarterly sampling of monitoring wells and private wells shall be submitted no later than the fifteenth (15th) day of the following months: February, May, August, and November.
18. All samples shall be analyzed by State certified laboratories using approved EPA methods for the type of analysis to be

performed. All laboratories shall maintain quality assurance/quality control records for Board review.

19. All hydrogeologic plans, specifications, reports, and documents shall be signed by or stamped with the seal of a registered geologist, engineering geologist, or professional engineer.
20. LINL shall maintain in good working order, and operate as efficiently as possible, any facility or control system installed to achieve compliance with the requirements of this Order.
21. Copies of all correspondence, reports, and documents pertaining to compliance with the Prohibitions, Specifications, and Provisions of this Order shall be provided to the following agencies:
 - a. California Department of Health Services/TSCD
 - b. State Water Resources Control Board
 - c. U.S. Environmental Protection Agency/Region IX
 - d. Zone 7 of the Alameda County Flood Control and Water Conservation District
22. Orders Nos. 85-134 and 86-95 are hereby rescinded.
23. The dischargers shall permit the Board or its authorized representative, in accordance with Section 13267(c) of the California Water Code, :
 - a. Entry upon premises in which any pollution sources exist, or may potentially exist, or in which any required records are kept.
 - b. Access to copy any records required to be kept under the terms and conditions of this Order.
 - c. Inspection of any monitoring equipment or methods required by this Order.
 - d. Sampling of any ground water or soil which is accessible, or may become accessible as part of any investigation or remedial action program, to the discharger.
24. The dischargers shall file a report on any changes in site occupancy and ownership associated with the facility described in this Order.
25. LINL shall report any newly discovered spill of oil or other hazardous material. Spills shall be reported to this Regional Board at (415) 464-1255 on weekdays during office hours from 8 a.m. to 5 p.m., and to the Office of Emergency Services at (800) 852-7550 during non-office hours, by telephone immediately after discovery of occurrence. A written report shall be filed with the Regional Board within five (5) working days and shall contain information relative to the nature of waste or pollutant, quantity involved, duration of incident, cause of spill,

estimated size of affected area, nature of effects, corrective measures that have been taken or planned, and a schedule of these activities, and persons notified.

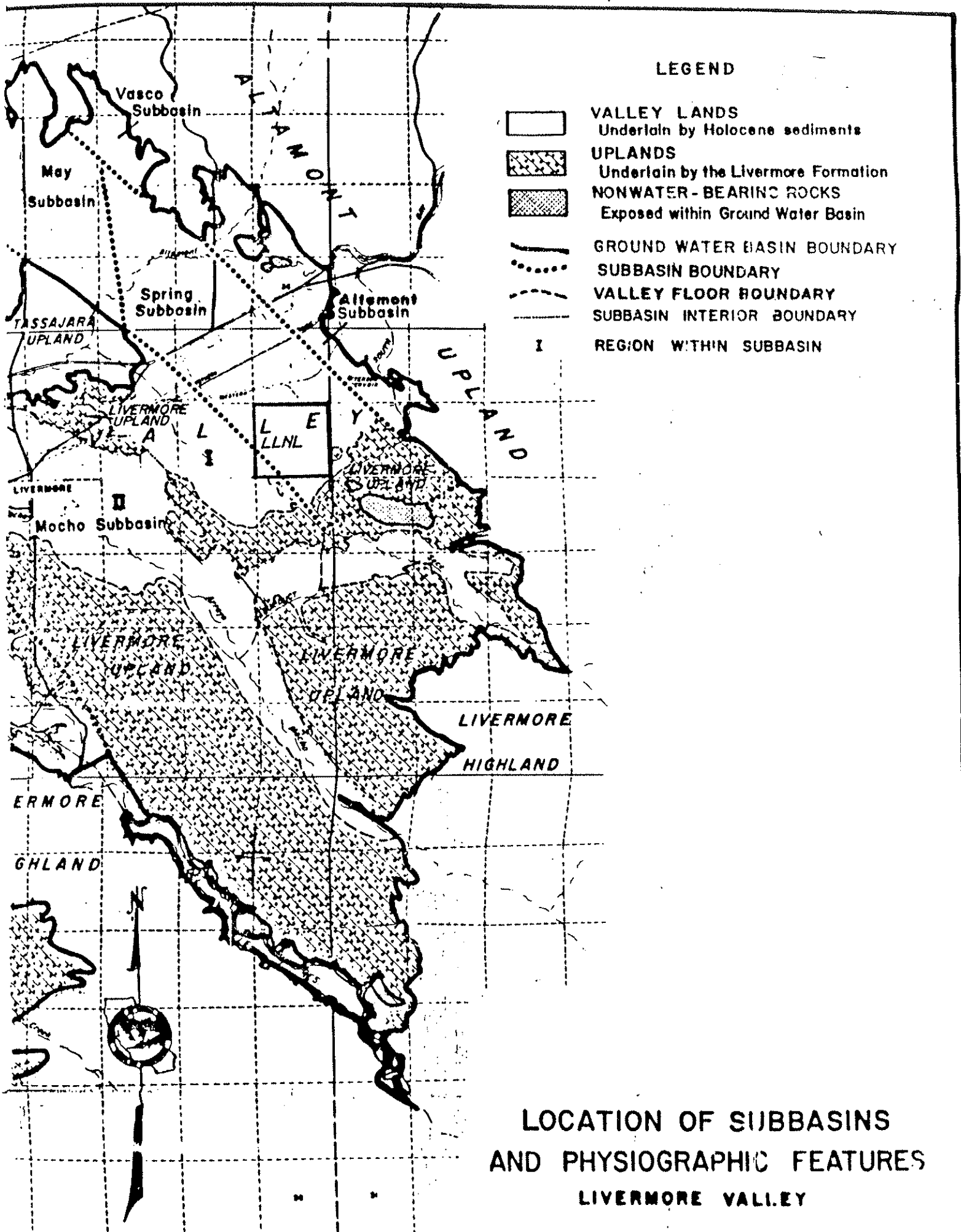
26. Within sixty (60) days of the Executive Officer's determination and actual written notice to the U.S. Department of Energy (owner) that the Lawrence Livermore National Laboratory (operator) has failed to comply with Provisions C.2, C.3, C.4, C.5, C.6, C.7, C.8, C.9, C.10, C.11, C.12, C.13, C.14, C.15, C.16, C.17, C.18, C.19, C.20, C.21 and C.25, the U.S. Department of Energy, as landowner shall comply with these Provisions.
27. The Board will review this Order periodically and may revise the requirements or compliance schedules when necessary. Interim and final cleanup limits shall be established by Board action once compliance with Specifications and Provisions is achieved.

I, Roger B. James, Executive Officer, do hereby certify the foregoing is a full, true and correct copy of an Order adopted by the California Regional Water Quality Control Board, San Francisco Bay Region, on August 19, 1987.


ROGER B. JAMES
Executive Officer

Attachments:

1. Location of Subbasins
2. Ground Water Contour Map
3. Locations of Hazardous Waste Releases and Areas of Suspected Pollution



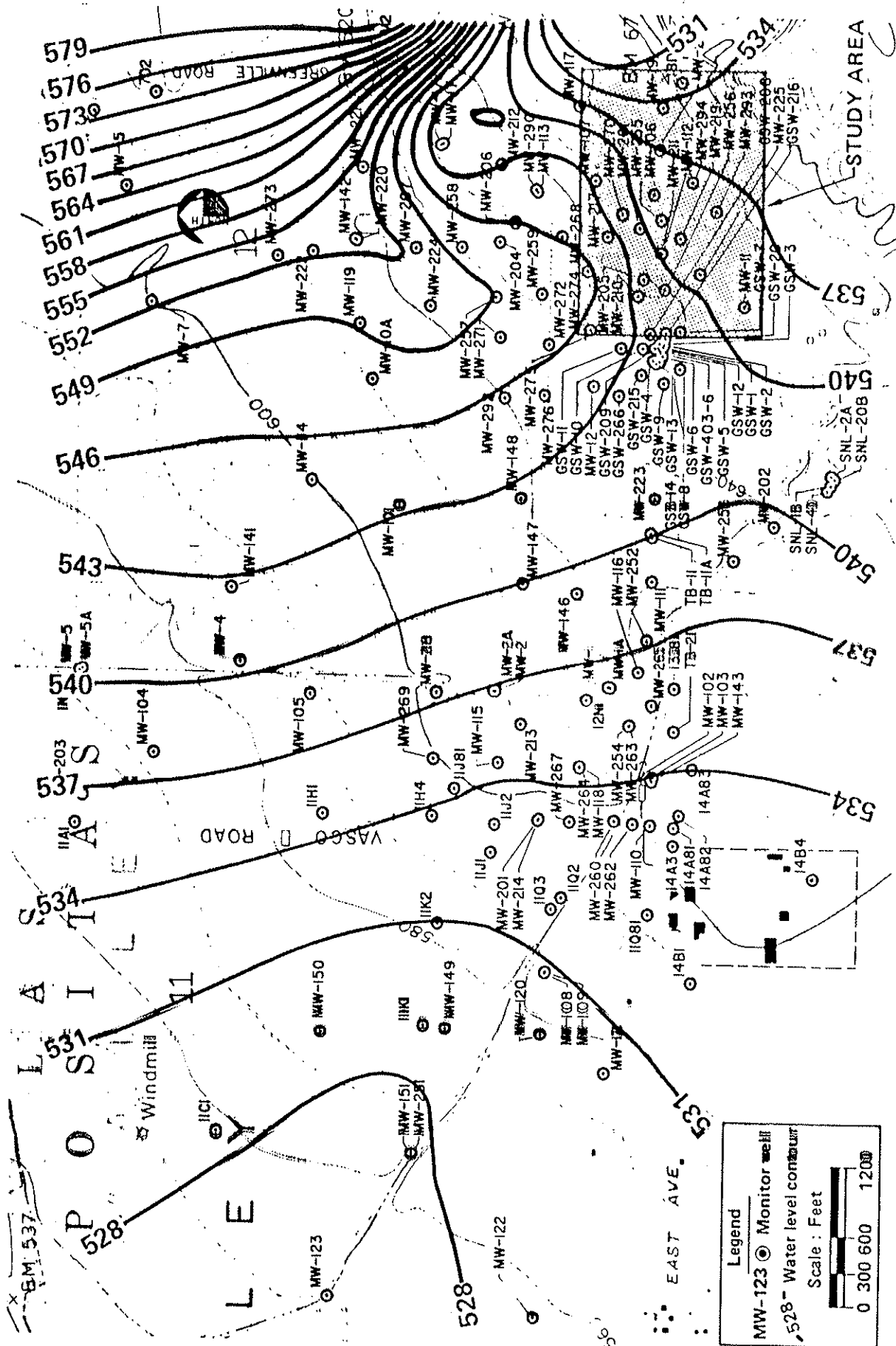


Figure 17. Ground water contour map, September 1986, LLLNL and vicinity.

